

Hilary M. Hurst

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CURRENT POSITION

Assistant Professor, Department of Physics & Astronomy, San José State University, San José, California

AREAS OF SPECIALIZATION

Condensed matter theory: many-body quantum systems, weak measurement, quantum gases, spin-orbit coupling, topological defects.

Dissertation Title: Dynamics of Topological Defects in Hybrid Quantum Systems

Dissertation Advisor: Professor Victor Galitski

APPOINTMENTS HELD

2018-20 *National Research Council Postdoctoral Fellow*, National Institutes of Standards and Technology and Joint Quantum Institute, Gaithersburg, Maryland

EDUCATION

2018 PhD, Physics, University of Maryland
2013 MAST, Applied Mathematics and Theoretical Physics, University of Cambridge, UK
2012 BSc, Engineering Physics, Minor: Public Affairs, Colorado School of Mines

TEACHING EXPERIENCE

University of Maryland, College Park
2017 University Teaching and Learning Program Completion: Associate Level, Teaching and Learning Transformation Center, University of Maryland
Voluntary certification program including course observations of undergraduate physics courses and workshop participation. Workshops included: avoiding stereotype threat, effective teaching tips, course design, and how to discuss academic integrity issues.
2017 Non-relativistic Field Theory (PHYS625)

2013 Guest Lecturer (2 lectures). Lectures covering mean field theory of Bose-Einstein condensation including condensate depletion and the Gross-Pitaevskii equation.
 Physics for Biologists I (PHYS131)
 Teaching Assistant, 1 semester. “Flipped” classroom developed by UMD physics education research group, with a focus on physics relevant to life sciences and pre-medical students.

Colorado School of Mines
 2012 Physics II: Electromagnetism and Optics (PHGN200)
 Lead Teaching Assistant, 1 semester
 2009-II Physics II: Electromagnetism and Optics (PHGN200)
 Teaching Assistant, 5 semesters
 2009 Physics I: Mechanics (PHGN100)
 Teaching Assistant, 2 semesters.
 PGHN 100 and 200 were developed by physics education researchers at Colorado School of Mines and are taught as hybrid lecture-studio courses. “Studio” is an independent learning environment where students spend 4 hours a week working in small groups to complete physics problems through hands-on activities and computer simulations. Teaching assistants help students make progress in studio by answering questions and clarifying activities.

RESEARCH EXPERIENCE

2018-20 *Postdoctoral Researcher*, Spielman Research Group, NIST/JQI
 Theory of weak measurement for many-body systems including numerical modeling of phase contrast imaging in spinor Bose-Einstein condensates. Creation and manipulation of novel many-body phases using measurement and feedback control.
 2014-18 *Research Assistant*, Galitski Group
 Condensed matter theory including spin-orbit coupling in atomic gases, topological insulators (TI) and interplay of TI surface states and unconventional magnetic textures such as skyrmions and magnetic vortices. Combination of analytical and numerical techniques including scattering theory, non-relativistic quantum field theory and simulations of Gross-Pitaevskii equations for Bose-Einstein condensates.
 2016 Smr *Research Intern*, Laboratory for Physical Sciences
 Theoretical modeling of noninvasive spectroscopy of Si/SiGe quantum wells. Development of new ways to measure valley splitting using longitudinal coupling. Valley splitting determines the effectiveness of a Si/SiGe quantum well as a spin qubit.
 2012 Spr *Senior Design Project*, Colorado School of Mines
 Exploited the entanglement properties of quantum dots to perform simple logic functions. Computational quantum simulations in Mathematica were used to design a quantum dot molecule for uses in quantum computing.
 2011 Smr *Undergraduate Research Intern*, Colorado Nanofabrication Lab
 Fabrication and testing of GaAsBi/GaAs heterojunction bipolar transistors including photoresist spinning, etching, 4-point resistance measurements and e-beam lithography.

2010-11 *Undergraduate Research Intern*, Advances Explosives Research Group, CO School of Mines
 Researched and modeled the effectiveness of different types of explosives for use in avalanche blasting. Worked in conjunction with Colorado Department of Transportation and Loveland Ski Patrol to test explosive charges in snow.

SERVICE

University of Maryland, College Park

2013-17 Mentor for Graduate & Undergraduate Mentoring programs, *UMD Women in Physics*
 Volunteered for a structured mentoring program to pair graduate students with more junior graduate students or undergraduates. Provided advice on graduate school applications, coursework, and academic life.

2015-17 Physics Department Representative, *UMD Graduate Student Government*
 Elected representative position, advocated for campus-wide adoption of Mutual Expectation Agreements (MEA) between faculty advisors and graduate researchers.

2015- Reviewer
Scientific Reports
Annals of Physics
New Journal of Physics
Physical Review Letters
Physical Review B

2014-15 Event Coordinator, *UMD Women in Physics*

Colorado School of Mines

2010-12 VP of Communications, *Society of Women Engineers, CSM Student Chapter*

2009-10 English Tutor, *McClain Senior High School*
 Volunteer English as a Second Language (ESL) tutor to an adult English language learner. Responsibilities included attending Literacy Coalition of Colorado tutor trainings, lesson planning, and weekly meetings with the student.

GRANTS, HONORS, & AWARDS

2018 National Research Council Postdoctoral Fellowship, NIST

2017 Outstanding Graduate Assistant, University of Maryland

2015 George A. Snow Memorial Award, University of Maryland Physics Department

2014 National Physical Sciences Consortium Graduate Research Fellowship, NSA/NPSC

2012 Physics Faculty Distinguished Graduate Award, Colorado School of Mines

2012 President's Senior Scholar-Athlete Award, Colorado School of Mines

2012 Summa Cum Laude, Colorado School of Mines

2010 Division II All-American, Track and Field Distance Medley Relay, NCAA

PUBLICATIONS & TALKS

REFEREED JOURNAL ARTICLES

2020

- Hurst, H. M.**, Galitski, V. & Heikkilä, T. T. (2020). “Electron Induced Massive Dynamics of Magnetic Domain Walls.” *Physical Review B*, 101(5), 054407.
- 2019 **Hurst, H. M.** & Spielman, I. B. (2019). “Measurement-induced dynamics and stabilization of spinor-condensate domain walls.” *Physical Review A*, 99(5), 053612.
- 2019 Shim, Y.-P., Ruskov, R., **Hurst, H. M.**, Tahan, C. (2019). “Induced quantum dot probe for material characterization.” *Applied Physics Letters* 114, 152105.
- 2017 **Hurst, H. M.**, Efimkin, D. K., Spielman, I. B., & Galitski, V. (2017). “Kinetic theory of dark solitons with tunable friction.” *Physical Review A*, 95(5), 053604.
- 2017 Aycock, L. M., **Hurst, H. M.**, Efimkin, D. K., Genkina, D., Lu, H. I., Galitski, V. , & Spielman, I. B. (2017). “Brownian motion of solitons in a Bose–Einstein condensate.” *Proceedings of the National Academy of Sciences*, 114(10), 2503–2508.
- 2016 **Hurst, H. M.**, Wilson, J. H., Pixley, J. H., Spielman, I. B., & Natsu, S. S. (2016). “Real-space mean-field theory of a spin-1 Bose gas in synthetic dimensions.” *Physical Review A*, 94(6), 063613.
- 2016 **Hurst, H. M.**, Efimkin, D. K., & Galitski, V. (2016). “Transport of Dirac electrons in a random magnetic field in topological heterostructures.” *Physical Review B*, 93(24), 245111.
- 2015 **Hurst, H. M.**, Efimkin, D. K., Zang, J., & Galitski, V. (2015). “Charged skyrmions on the surface of a topological insulator.” *Physical Review B*, 91(6), 060401(R).

PREPRINTS

- 2020 **Hurst, H. M.**, Guo, S., & Spielman, I. B. (2020). “Feedback Induced Magnetic Phases in Binary Bose-Einstein Condensates.” arXiv:2007.07266.
- 2020 Flebus, B., Duine, R. A. & **Hurst, H. M.** (2020). “Non-Hermitian topology of one-dimensional spin-torque oscillator arrays.” arXiv:2003.01152.

NON-REFEREED ARTICLES

- 2015 **Hurst, H. M.** (2015). “Women in Physics Hosts Career Panel.” *APS Gazette*, 34(2), 3.
- 2013 **Hurst, H. M.** (2013). “New Perspectives on the Aharonov-Bohm Effect.” *Part III Essay*. University of Cambridge.

INVITED PRESENTATIONS

- 2020 *Quantum Control with Spinor Bose-Einstein Condensates*, Open Quantum Frontiers Workshop, Golden, CO.
- 2019 *Transport signatures of Dirac states in topological insulator - ferromagnet heterostructures*, KITP Seminar, Santa Barbara, CA.
- 2019 *Electron Induced Massive Dynamics of Magnetic Domain Walls*, University of Delaware Condensed Matter Seminar, Newark, DE.
- 2018 *What can weak measurements tell us about Bose-Einstein condensates?*, APS Mid-Atlantic Section Meeting, College Park, MD.
- 2018 *Transport signatures of Dirac electrons in a random magnetic field*, JQI Seminar, Joint Quantum Institute, College Park, MD.
- 2017 *Understanding dissipative dynamics of dark solitons: results from experiment and theory*, Gordon Research Seminar. Salve Regina University, Newport, RI.

2015 *Charged skyrmions on the surface of a topological insulator*, Workshop on Topological Spintronics and Skyrmionics. Institut Néel, Grenoble, France.

CONTRIBUTED PRESENTATIONS

2019 *Measurement induced dynamics and defect stabilization in spinor condensates*, APS March Meeting. Boston, MA.
2018 *Magnetic phases in a spinor Bose-Einstein condensate subject to weak measurement*, APS DAMOP Division Meeting. Ft. Lauderdale, FL.
2017 *Controllable friction of dark solitons in Bose-Fermi mixtures*, APS March Meeting. New Orleans, LA.
2016 *Transport signatures of Dirac electrons in a random magnetic field*, APS March Meeting. Baltimore, MD.
2015 *Charged skyrmions on the surface of a topological insulator*, APS March Meeting. San Antonio, TX.
2012 *Virtual realization of an excitonic quantum computer*, Physics Colloquium, Colorado School of Mines. Golden, CO.

CONFERENCE & WORKSHOP ATTENDANCE (SELECTED)

2020 Feb Open Quantum Frontiers Institute Workshop, Golden, CO.
2019 Nov KITP Program: Spin and Heat Transport in Quantum and Topological Materials, Santa Barbara, CA.
2019 Apr KITP Program: Open Quantum System Dynamics; Quantum Simulators and Simulations Far From Equilibrium, Santa Barbara, CA.
2019 Mar APS March Meeting, Boston, MA.
2018 Nov APS Mid-Atlantic Section Meeting, College Park, MD.
2017 June NYU Center for Quantum Phenomena Inaugural Symposium, New York, NY.
2017 June Atomic Physics Gordon Research Conference: From Quantum Control to Tests of Fundamental Physics, Newport, RI.
2017 June Atomic Physics Gordon Research Seminar: Hybrid Atomic Systems in the Quantum Regime, Newport, RI.
2017 May SPICE Workshop: Non-Equilibrium Quantum Matter, Mainz, Germany.
2016 Oct KITP Program: Synthetic Quantum Matter, Santa Barbara, CA.
2015 Oct Workshop on Topological Spintronics and Skyrmionics, Grenoble, France.
2015 Aug Cargèse Summer School: Strongly Correlated Materials with Spin-Orbit Coupling, Corsica, France.

OTHER PROFESSIONAL QUALIFICATIONS

2016-2018 *TS/SCI Cleared*. Most recent polygraph: February 25, 2016.

PROGRAMMING EXPERIENCE

Fluent in Python, Mathematica, and Julia
Some experience with MATLAB and Git

MEMBERSHIPS

2009- American Physical Society
2010 Sigma Pi Sigma (Physics Honor Society), year inducted.
2009 Tau Beta Pi Colorado Alpha Chapter (Engineering Honor Society), year inducted.
2008-12 Society of Women Engineers.

REFERENCES

Prof. Victor Galitski

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Joint Quantum Institute
University of Maryland
College Park, MD 20742 USA
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Last updated: August 13, 2020 • compiled in XeLaTeX